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MINERALOGY AND PETROGRAPHY<sup>1</sup>

**Mineralogical News.**—The long expected monograph by Brögger<sup>2</sup> on the minerals of the syenite-pegmatite veins of the augite syenite and nepheline syenite region of Southern Norway has at last made its appearance. The special part of the volume, which describes in great detail seventy mineral species, is prefixed by an introduction of 235 pages, in which the geology of the region is discussed and the eruptive nature of the pegmatite veins is proved. An abstract of this portion of the work will be given in another place. Of the seventy mineral species recognized in the veins five are of sulphides, one is a sulpho-salt, three are oxides, three are hydroxides, one is a haloid compound, one a ferrate, two are borates, two phosphates, two are members of the zircon group, three belong to the epidote group, two to the group of the datholites, three to the garnets, three to the micas, two to the nepheline group, two to the leucophanes, seven to the pyroxenes, four to the hornblendes, four are members of the melanocerite group, three are feldspars, seven are zeolites, and nine others are various silicates. The only carbonate detected, beside two fluo-carbonates, is calcite. It is evidently impossible to mention even all of the important discoveries made by the author in his studies of the wonderful suite of specimens collected by him. We can only refer briefly to the most important of them. Measurements of *töllingite* yielded  $a : b : c = 6689 : 1 : 1.2331$ . Tabular crystals of *hydrargillite* gave  $a : b : c = 1.7089 : 1 : 1.9184$ ;  $\beta = 85^\circ 29' 10''$ . These are occasionally un-twinned, but more frequently twinned forms are found in which the twinning planes are  $\infty P$  (corresponding to DesCloizeaux twins par.  $\infty P\overline{\infty}$ ),  $\infty P\overline{\infty}$  (occasionally),  $\frac{1}{18} P_{\frac{2}{3}}$  (?), and  $oP$ ; and a fifth form in which the twinning plane is perpendicular to  $oP$ . Optically, plates of the mineral act uniaxially. *Xenotime*, while containing many elements, yielded upon analysis figures that may be reduced to correspond to the formula  $Y_2(PO_4)_2$ . An examination of thin sections of *orthite* (*allanite*) shows its extinction in  $\infty P\overline{\infty}$  to vary between  $37\frac{1}{2}^\circ$  and  $28\frac{1}{2}^\circ$  in acute  $\beta$ . The plane of the optical axes is perpendicular to  $\infty P\overline{\infty}$ , and the double refraction is négativé. Analysis of carefully purified *homilite* gave:

SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	Ce <sub>2</sub> O <sub>3</sub>	B <sub>2</sub> O <sub>3</sub>	FeO	CaO	Na <sub>2</sub> O	H <sub>2</sub> O
31.83	2.72	.88	.24	16.51	16.74	29.54	.75	.79

<sup>1</sup> Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

<sup>2</sup> *Zeits. f. Krystall.*, XVI. Specialler Theil, 664 pp., xxvii. Pl.

Single crystals are described, and twins following four twinning laws are well illustrated in the plates. The optical properties of the mineral are briefly sketched. Several varieties of *garnet* are mentioned, two analyses of which are worth recording. The black-green garnet of Stokö and the yttrium garnet of the same locality contain respectively:

SiO <sub>2</sub>	TiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	Mn <sub>2</sub> O <sub>3</sub>	Y <sub>2</sub> O <sub>3</sub>	MnO	MgO	CaO	Na <sub>2</sub> O	H <sub>2</sub> O
34.90		8.97	20.43			2.40	tr.	31.38		1.27
31.51	3.52	2.01	26.68	2.15	.38		.38	30.78	.79	.43

*Nordenskjöldite*, with an axial ratio of  $a : c = 1 : .8221$ , has a composition corresponding to  $\text{Ca}(\text{BO})_2 \text{SnO}_4$ . *Astrophyllite*, as the result of new measurements, is concluded to be orthorhombic with  $a : b : c = 1.0098 : 1 : 4.7556$ . Its fracture figure (on the perfect cleavage parallel to  $\infty P \infty$ ) consists of two lines crossing each other at angles of about  $81^\circ$  and  $98^\circ$ , the smaller of which is bisected by the vertical axis. The gliding planes correspond very nearly to those of the dome  $\frac{1}{4} P \infty$ . The axial plane is the base, with  $b$  the positive acute bisectrix. A new analysis of carefully purified material shows slight differences from the previously published analyses, and corresponds closely to the formula  $\text{R}_4'' \text{R}_4' \text{Ti}(\text{SiO}_4)_4$ . *Leucophane* crystals to the number of twenty gave good enough reflections to enable Brögger to determine without difficulty their orthorhombic symmetry,  $a : b : c = .9939 : 1 : .6722$ . The axial plane is the macropinacoid and  $c$  is the negative acute bisectrix.  $2E_{na} = 74^\circ 15'$ . *Melinophane* crystalizes in the tetartohedral division of the tetragonal system. Optically it is uniaxial. Chemically it differs from leucophane  $[\text{Na}_3(\text{FBe})_3\text{Ca}_3(\text{SiO}_3)_6]$  in containing more beryllium [i. e. it is  $\text{Na}_2(\text{FBe})_2(\text{Ca}_2\text{O})_2\text{Be}_2(\text{SiO}_3)_6$ ]. A thorough discussion of the characteristics of *acmite* and *ægerine* leads to the view that they are well marked varieties of the same pyroxene, closely related to diopside. Acmite is nearly always twinned, while ægerine is usually in simple crystals. *Låvenite* according to the most recent measurements has  $a : b : c = 1.0963 : 1 : .7151$  and  $\beta = 69^\circ 42\frac{1}{2}'$ . *Wöhlerite* usually occurs in twins, whose twinning plane is the orthopinacoid. When placed in the conventional position for pyroxene its axial ratio becomes  $a : b : c = .9966 : 1 : .3547$  with  $\beta = 89^\circ 18' 50''$ . Its absorption is  $C > B = A$ , and pleochroism varies between yellow and colorless shades. *Låvenite* and *Wöhlerite* are regarded as zirconium pyroxenes, closely related to the corresponding triclinic pyroxene *hiortdahlite*. *Polymignite* crystals are orthorhombic, as is well known, with the axial ratio  $.7121 : 1 : .5121$ . Their hardness is 6–6.5, and density 4.77–4.85. Chemically and morphologically the mineral is

closely related to *æschynite*, with which it forms a group distinct from all other natural mineralogical groups. When placed in a position corresponding to the usual one for *æschynite* its axial ratio becomes  $a : b : c = .4681 : 1 : .7192$ . Measurements of the best *arfvedsonite* crystals gave  $.5496 : 1 : .2975$  as the axial ratio for this species, with  $\beta = 75^\circ 44\frac{1}{2}'$ . The analysis of a large crystal yielded (after treating with acid to dissolve magnetite):

SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	MnO	MgO	Na <sub>2</sub> O	K <sub>2</sub> O	H <sub>2</sub> O
49.90	2.62	32.99	.05	.57	12.88	.10	1.07

*Pterolite* is regarded as an alteration product of *barkevikite*, consisting of a mixture of *lepidomelane* and *ægerine*, and *ainigmatite* is thought to be identical with *cosyrite*. An optical examination of *katapleite* proves it to be monoclinic with  $a : b : c = 1.7329 : 1 : 1.3618$  and  $\beta = 89^\circ 48\frac{1}{2}'$ , and not hexagonal as formerly supposed, although it assumes the hexagonal symmetry when heated to  $140^\circ$ . Two varieties of the mineral are recognized. The first is a yellow variety to which the name *katapleite* is assigned, and the second a blue variety which is called *soda-katapleite*. The composition of the varieties is given as follows:

	SiO <sub>2</sub>	ZrO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	FeO	CaO	Na <sub>2</sub> O	H <sub>2</sub> O
I	41.56	32.53	1.02		5.21	9.74	9.35
II	44.04	30.94		.10	.87	14.94	9.24

*Tritonite*, according to Brögger, does not crystallize in the regular system, but is probably rhombohedral and hemimorphic. In this case  $a : c = 1 : 1.114$ . The analyses that have been published as those of *Erdmannite* are thought to be analyses of a mixture of a melanocerite mineral with a member of the *homilite* group. *Eukotite-titanite* is a deep brown variety of *sphene*, with most of the optical and crystallographic properties of this mineral, but differing from it slightly in composition, which is as follows:

SiO <sub>2</sub>	ZrO <sub>2</sub>	TiO <sub>2</sub>	CeO <sub>2</sub>	Ce <sub>2</sub> O <sub>3</sub>	Y <sub>2</sub> O <sub>3</sub>	CaO	FeO	MgO	Na <sub>2</sub> O	K <sub>2</sub> O	Loss
30.22	.18	34.78	2.57		.59	24.38	3.84	.50	.86	.27	.31

The *soda-orthoclase* of Fredriksvärn turns out upon close examination to be an intergrowth of such fine lamellæ of albite and orthoclase, that upon examination with low powers of the microscope, a section of this mineral behaves as if monoclinic. Brögger calls it *cryptoperthite*. *Eudidymite* has been carefully examined and its properties well established. It is a monoclinic mineral, resembling in appearance *heulandite*. Its axial ratio is  $a : b : c = 1.7107 : 1 : 1.1071$ , and  $\beta = 86^\circ 14'$

27". It occurs in tabular crystals, with a perfect cleavage parallel to the base; a hardness of 6 and a specific gravity of 2.553. The extinction in  $\infty P\infty$  is inclined  $58\frac{1}{2}^\circ$  to  $c$  and  $27^\circ 45'$  to the cleavage parallel to  $oP$ .  $2V_a = 29^\circ 55'$  for sodium light. Very exact measurements of a large number of *natrolite* crystals from Little—ar $\delta$  indicate that the mineral is monoclinic with  $a : b : c = 1.0165 : 1 : 1.3599$ , and  $\beta = 89^\circ 54' 52''$ , and not orthorhombic as is usually assumed. The orthorhombic symmetry, which is ordinarily observed, is due to twinning parallel to the orthopinacoid. These monoclinic natrolites differ from the ordinary orthorhombic form in containing a small quantity of potassium. The extinction angle increases with the potassium content. *Bergmannite* and *brevicite* are shown by the author to be either natrolite, or mixtures of this mineral with several other substances.

**New Minerals.**—*Hambergite*. A single specimen of this mineral is of grayish white color, and is orthorhombic with  $\infty P$ ,  $\infty P\infty$ ,  $\infty P\infty$  and  $\infty P$ .  $a : b : c = .7988 : .7267$ , and hardness = 7.5. Sp. Gr. = 2.347. Plane of the optical axes is  $\infty P$ ,  $\infty$  and  $c$  is the acute bisectrix.  $2V_{na} = 87^\circ 7'$  (observed) or  $87^\circ 40'$  (calc.). Analyses yielded:  $BeO = 53.25\%$ ;  $H_2O = 10.03$ ;  $B_2O_3 = 36.72$ ;  $=(HO) Be_2BO_3$ . — *Johnstrupite* was originally confused by Brogger with mosandrite, which it resembles in many respects. Careful observation shows its axial ratio to be  $a : b : c = 1.6229 : 1 : 1.3594$ .  $\beta = 86^\circ 55\frac{1}{2}'$ , and the plane of its optical axis the clinopinacoid, with the positive acute bisectrix inclined  $2\frac{1}{2}^\circ$  to  $c$ , in which it closely resembles mosandrite. The latter mineral however is reddish brown when fresh, while johnstrupite is brownish green. That they are two distinct minerals is shown by their composition, which corresponds respectively with the formulas  $(OH)_6F_2H_{12}R_4Na_2Ca_{10}Ce_2(SiO_4)_{12}$  for mosandrite, and  $F_7H_2R_3Na_6Ca_{12}Ce_2MgAl(SiO_4)_{12}$  for johnstrupite. The similarity in composition and morphological properties between these two minerals and epidote leads the author to regard them as members of same group. — *Calciorthorite* is a deep reddish brown amorphous substance, with a hardness of 4.5 and a sp. gr. of 4.114. Its composition is:

SiO <sub>2</sub>	ThO <sub>2</sub>	Ce <sub>2</sub> O <sub>3</sub>	Y <sub>2</sub> O <sub>3</sub>	Al <sub>2</sub> O <sub>3</sub>	Mn <sub>2</sub> O <sub>3</sub>	CaO	MgO	Na <sub>2</sub> O	H <sub>2</sub> O
21.09	59.35	.39	.23	1.02	.73	6.93	.04	.67	9.39,

corresponding to  $5ThSiO_4 \cdot 2[Ca_2SiO_4] + ca. 10H_2O$ . — *Hiortdahlite* is a triclinic pyroxene occurring in small, thin, tabular crystals of a yellowish or yellowish brown color. Its crystallographic constants are  $a : b : c = .9981 : 1 : .3537$ ,  $\alpha = 89^\circ 30' 57''$ ,  $\beta = 90^\circ 29' 6''$ ,  $\gamma = 90^\circ 6' 10''$ . The crystals are elongated in the direction of the

vertical axis, and are flattened in the direction of the macropinacoid. Like wöhlerite, nearly all hiortdahlite crystals are twinned. In the latter case the twinning plane is at right angles to the vertical axis, and the combination face is the macropinacoid. The axial angle is large. The optically positive first bisectrix is sharply inclined to the vertical axes. The extinction on the  $\infty P\infty$  is  $25^\circ$  and on  $\infty P\infty$  is about  $15\frac{1}{2}^\circ$ . No well marked cleavages are observed in any sections. The specific gravity is 3.235—3.267, and the composition :

SiO <sub>2</sub>	TiO <sub>2</sub>	ZrO	ZrF <sub>2</sub> O	Fe <sub>2</sub> O <sub>3</sub>	FeO	MnO	CaO	MgO	Na <sub>2</sub> O	H <sub>2</sub> O
31.89	1.50	2.88	22.00	.34	.94	.96	32.53	.10	6.53	.58

—*Cappelinite*, the discovery of which was announced some years ago by Brogger, occurs in hexagonal prisms with  $\infty P$ ,  $\frac{1}{2} P$  and  $P$ .  $a : c : \infty = 1 : 1.2903$ . Their double refraction is negative and their composition is as follows :

SiO <sub>2</sub>	B <sub>2</sub> O <sub>3</sub>	Y <sub>2</sub> O <sub>3</sub>	La <sub>2</sub> O <sub>3</sub>	CeO <sub>2</sub>	ThO <sub>2</sub>	BaO	CaO	Na <sub>2</sub> O	K <sub>2</sub> O	Loss
14.66	16.98	52.62	2.97	1.29	.80	8.29	.67	.53	.22	.61,

corresponding to the molecular combination of  $R_2^{IV}(\text{SiO}_3)_2$  and  $R^{IV}(\text{BO}_3)_2$ . The hardness of the mineral is 6, and its specific gravity is 4.407. It is regarded as a member of the melanocerite group, to which also the following named mineral is supposed to belong. This mineral, *karyocerite*, is likewise hexagonal. Its axial ratio is  $1 : 1.1845$ , and its specific gravity 4.295. It differs from melanocerite in containing much more cerium and thorium ( $\text{CeO}_2$  and  $\text{ThO}_2$ ). It occurs in nut-brown tables with a rhombohedral habit.—*Weibyeite* occurs in small crystals with a tetragonal habit. In form they resemble zircon, but are really orthorhombic, as their optical investigation shows, with the vertical axis that of least elasticity.  $a : b : c = .9999 : 1 : .64$ . It was impossible to separate the mineral from the pairsite associated with it, but an analysis of the mixture leads to the view that weibyeite corresponds in composition to the formula  $[(\text{Ce}, \text{La}, \text{Di})\text{F}]_2(\text{CO}_3)_2$ .—*Barkevikite*, although long known as a variety of hornblende, has received but little attention in recent years. A new analysis shows it to have the following composition :

TiSiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	FeO	MnO	CaO	MgO	Na <sub>2</sub> O	K <sub>2</sub> O
42.46	11.45	6.18	19.93	.75	10.24	1.11	6.08	1.44

Although chemically not very different from arfvedsonite, its physical properties readily distinguish it from this species. The extinction is  $12\frac{1}{2}$  in the acute  $\beta$ , while in arfvedsonite it is in obtuse  $\beta$ .

This latter mineral is pleochroic in blue and green tints, while the former is pleochroic in brown and brownish red tints. Barkevikite is an essential constituent of the augite syenite occurring between the fjords of Christiania and Langesund.—*Spangolite* is proposed by Penfield<sup>3</sup> as the name for a hydrated sulphate and chloride of copper, occurring, probably, somewhere in the Globe District, Arizona. The new mineral incrusts cuprite, and is associated with azurite and atacamite (?). It is rhombohedral, with its crystals bounded by oP and a series of pyramids of the second order. The cleavage is perfect parallel to oP. Etched figures produced on the basal plane by the use of dilute acids are bounded by oP and scalenohedral faces. They are all very clear, and all have an undoubted rhombohedral symmetry. By reflected light the mineral is dark green, while by transmitted light it is light green. Pleochroism is slight. The double refraction is strong and negative, with  $\alpha=1.694$ ,  $\epsilon=1.641$ . Hardness on oP is 2, and on the pyramidal faces 3. Specific gravity is 3.141. The average of four analyses gives:

SO <sub>3</sub>	Cl	Al <sub>2</sub> O <sub>3</sub>	CuO	H <sub>2</sub> O
10.11	4.11	6.60	59.51	20.41

corresponding to  $\text{Cu}_6\text{AlClSO}_4 \cdot 9\text{H}_2\text{O}$ .

## BOTANY.

**Some Reasons for Varieties not soon Wearing Out.**—The direct result of a union of two or more distinct protoplasmic masses, in plant life, is a condensed, inactive, and transportable condition of the life of the species, that is, a seed or spore. Among lower plants this reproductive union usually takes place in the simplest manner, and at times that are determined by unfavorable circumstances for a further continuance of the life of the species in its ordinary rapidly-growing condition. Thus the moulds form their resting spores when the prospects are that resting spores will be most needed to carry the life of the species over the approaching period of cold, drought, or lack of food supply. The uniformity of the coming and going of the seasons has its parallel in the uniformity with which the higher plants produce their annual crop of seeds. In the great struggle for life that is going on, it is perhaps true that some species have found it to their advantage to form their seed early, and long before the time when the season

<sup>3</sup> *Amer. Jour. Science*, May, 1890, p. 370.